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भारत सरकार  
Ministry of Labour and Employment  
श्रम एवं रोजगार मंत्रालय  
Directorate General of Mines Safety  
खान सुरक्षा महानिदेशालय



सं० DGMS Technical circular/ 02

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सेवा में

खान मालिक, अभिकर्ता, और प्रबन्धक,  
कौला एवं मेटालिफेरास माइन्स ।

**Sub: Precautions while charging Nitrogen gas in Accumulator cylinder of machinery.**

Inquiry into a fatal accident occurred in a mechanized open cast mine revealed that while engine of a 240 tone capacity dumper was started in a workshop after charging one of the two accumulator in hydraulic circuit with oxygen instead of nitrogen, an explosion took place in the charged accumulator cylinder with in two minutes causing bursting of the cylinder into pieces along with huge flare created by ignited hydraulic fluid which inflicted fatal injury to the engineer and burn injuries to three workers who are at a distance of about 18m.

Once the oxygen was charged in to the accumulator cylinders and engine was started the hydraulic oil entered the accumulator cylinder from bottom at about 3500 psi. The highly pressurized oil rapidly compressed the oxygen filled in the bladder there by increasing its temperature beyond the flash point of hydraulic oil and melting point of polymer of the bladder. The instantaneous combustion of hydraulic oil led to explosion in the cylinder and ultimately bursting the same.

In order to prevent such type of accident in future the following safety measures shall therefore be followed:

1. Accumulator cylinders or suspension cylinder or any other applicable gas filled device used in Hydraulic circuit of mining equipment shall be charged only with gas as per recommendation of the OEM.
2. The content of the gas & its purity as recommended by the OEM shall be checked with suitable equipment before putting it to use.
3. Separate & distinct gas charging valve assembly shall be deployed on Oxygen & Nitrogen gas cylinders as per IS: 3224: 2002 there by eliminating the risk of inadvertent charging of the gas in the cylinder.
4. All cylinders shall be distinctly marked as specified in BIS specification to avoid any confusion.

5. Ensure the valve assembly is in good working condition and only use recommended tools for opening and closing. The valve protection rings must be provided to protect the valve assembly from damage while in storage or being handled.
6. Each type of gas shall be kept separately in workshop stores in a cool, dry & well ventilated place away from combustible materials and electrical connections.
7. The cylinders shall be stored in upright position & immobilized by chains or other clamping devices to prevent them from falling.
8. Handling and transportation of Nitrogen cylinders must be done in a safe manner e.g. use of wheeled trolleys.
9. In case of a leakage Nitrogen cylinder (which cannot be rectified by simple valve tightening) ensure the cylinder is moved to an open isolated location away from inflammable material/electrical connections and attach a tag to the cylinder indicating it is unserviceable and allow the cylinder to remain there till the gas is fully discharged. Contact the gas supply agency for proper disposal.
10. Use first in first out (FIFO) method to rotate cylinder stocks
11. Only authorized personnel shall handle cylinders.
12. Personnel must wear personal protective equipment when handling gases.
13. Awareness amongst the workers regarding the dangers of using Oxygen in accumulator cylinders shall be developed & suitable warnings should be displayed at charging points stations
14. Records of receipts and issues of gas cylinders and checking of purity etc shall be maintained and counter signed by Engineer and Manager of the mine.
15. Adequate number of fire extinguishing equipment must be readily available near to the place of cylinder storage & usage.
16. Gas supply agencies should provide test certificate indicating purity of the supplied gas.

**In the interest of safety, the above recommendations shall be implemented strictly to reduce the chances of accidents while charging Nitrogen in gas filled device used in machinery working in mines.**

*S. S. S.*  
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